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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/721,932	11/25/2003	K.R. Udayakumar	TI 35507	8320
23494	7590	09/27/2007	EXAMINER	
TEXAS INSTRUMENTS INCORPORATED			VINH, LAN	
P O BOX 655474, M/S 3999				
DALLAS, TX 75265				
			ART UNIT	PAPER NUMBER
			1765	
			NOTIFICATION DATE	DELIVERY MODE
			09/27/2007	ELECTRONIC

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

uspto@ti.com  
uspto@dlemail.itg.ti.com

**Office Action Summary**

Application No.

10/721,932

Applicant(s)

UDAYAKUMAR ET AL.

Examiner

Lan Vinh

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 23 March 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-25 is/are pending in the application.
- 4a) Of the above claim(s) 22-25 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-21 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Response to Arguments***

1. Applicant's arguments, see pages 2-5 of the response, filed on 3/23/2007, with respect to the rejection(s) of claim(s) 1-4, 8-10, 11, 18-21 under 35 U.S.C 103(a) based on Yang, Kim (763) and Kim (293) have been fully considered and are persuasive. Therefore, the rejection(s) has been withdrawn. However, upon further consideration a search, a new ground of rejection of claims 1-4, 11-14, 20 under 35 U.S.C 103(a) as based on newly cited reference of Chien et al (2002/0142610) and Kim (763) and previously allowable claims 6, 16 under 35 U.S. C based on Chien, Kim (763) and Demmin is set forth below

### ***Claim Rejections - 35 USC § 103***

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 3-4, 5, 8-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chien et al (2002/0142610) in view of Kim et al (US 6,500,763)

Chien discloses a method for manufacturing semiconductor device involves plasma etching of dielectric layer. The method comprises the steps of:

providing a substrate 114 (dielectric) having an etch stop layer 106 (SiN) located there under (page 3, paragraph 0026 )

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etching an opening in the substrate using an etchant comprising a carbon oxide (500 sccm > 80 sccm), C<sub>4</sub>F<sub>6</sub>/fluorocarbon, oxygen/an etch rate modulator and an inert carrier gas, the etchant is selective to the nitride etch stop layer (page 5, paragraph 0041, 0042)

Unlike the instant claimed invention as per claim 1, Chien fails to expressly disclose using an aluminum oxide etch stop layer

Kim (763) discloses a method for forming a semiconductor device comprises the step of forming an etch stop layer of SiN, aluminum oxide (col 4, lines 60-65)

One skilled in the art at the time the invention was made would have found it obvious to modify Chien method by forming an aluminum oxide etch stop layer as per Kim (763) because Kim teaches that by using an aluminum oxide or a SiN layer as the auxiliary etch stop layer, the extent of dry etching can be more delicately controlled (col 4, lines 65-67)

The limitations of claims 3-4, 8-9 have been discussed above

Regarding claim 5, Chien discloses that the ratio of CF to oxygen/etch modulator is 1:1 to 2:1 (page 2, paragraph 0014)

Regarding claim 10, Chien discloses forming a SAC/semiconductor device by etching (see abstract )

3. Claims 2, 6, 12, 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chien et al (2002/0142610) in view of Kim et al (US 6,500,763) and further in view of Demmin et al (US 6,635,185)

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Chien as modified by Kim (763) has been described above. Unlike the instant claimed inventions as per claims 2, 6, 12, 16, Chien and Kim (763) fails to disclose the specific claimed flow rate of carbon oxide, fluorocarbon and oxygen although Chien disclose the ranges of the flow rate that encompass the specific claimed flow rate (page 2, paragraph 0014). Demmin discloses, beginning at col 7, lines 15

As is well known, there are many operating conditions of a plasma etching process that can have an effect on the results obtained. These conditions include, for example, the type of plasma etching (for example, reactive ion etching, plasma etching, and high-density etching), etching composition, flow rate, wafer temperature, pressure, power, time and bias. The interrelationship of these parameters is a function of the hardware configuration and the material being etched. One skilled in the art of plasma etching and cleaning can vary these parameters accordingly to etch a desired material satisfactorily. Exemplary operating conditions include etching gas flow rates from about 1 to about

One skilled in the art at the time the invention was made would have found it obvious to vary the flow rates carbon oxide, fluorocarbon and oxygen in Chien and Kim method because Demmin teaches that changing the parameter such as flow rate according to the material being etched appears to reflect a result-effective variable which can be optimized. See MPEP 2144.05 IIB

4. Claims 7, 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chien et al (2002/0142610) in view of Kim et al (US 6,500,763) and further in view of Fitch et al (US 5324,683).

Chien as modified by Kim (763) has been described above. Unlike the instant claimed inventions as per claims 7, 17, Chien and Kim (763) fails to disclose using nitrogen in the etchant

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Fitch discloses a method for forming a semiconductor structure. The method comprises a step of etching an opening in the substrate using an etchant comprising a carbon oxide, CF<sub>4</sub>/fluorocarbon, nitrogen/an etch rate modulator and an inert carrier gas (col 9, lines 5-27)

One skilled in the art at the time the invention was made would have found it obvious to modify Chien and Kim by adding nitrogen to the etchant in view of Fitch teaching because Fitch discloses that any plasma environment containing fluorocarbon, CO may contain more inert carrier gas such as Ar, nitrogen (col 9, lines 20-25)

5. Claims 11, 13-14, 18-19, 20, 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over (2002/0142610) in view of view of Kim et al (US 6,500,763)

Chien discloses a method for manufacturing semiconductor device involves plasma etching of dielectric layer. The method comprises the steps of:

providing gate structure 210/semiconductor device over a semiconductor substrate (fig. 2B)

providing a dielectric layer 206 over the gate/semiconductor device, the dielectric layer having an etch stop 208 located thereunder (page 3, paragraph 0029)

etching an via/opening in the substrate using an etchant comprising a carbon oxide (500 sccm > 80 sccm), C<sub>4</sub>F<sub>6</sub>/fluorocarbon, oxygen/an etch rate modulator and an inert carrier gas, the etchant is selective to the nitride etch stop layer (page 5, paragraph 0041, 0042)

Chien also discloses forming a dual damascene by filling the via/opening with copper/conductive metal (page 1, paragraph 0007; page 3, paragraph 0032), which reads on making electrical contact to the devices through the opening (col 6, lines 45-50)

Unlike the instant claimed inventions as per claims 11, 20, Chien fails to expressly disclose using an aluminum oxide etch stop layer

Kim (763) discloses a method for forming a semiconductor device comprises the step of forming an etch stop layer of SiN, aluminum oxide (col 4, lines 60-65)

One skilled in the art at the time the invention was made would have found it obvious to modify Chien and Kim method by forming an aluminum oxide etch stop layer as per Kim (763) because Kim teaches that by using an aluminum oxide or a SiN layer as the auxiliary etch stop layer, the extent of dry etching can be more delicately controlled (col 4, lines 65-67)

The limitations of claims 13-14, 18 have been discussed above

Regarding claim 15, Chien discloses that the ratio of CF to oxygen/etch modulator is 1:1 to 2:1 (page 2, paragraph 0014)

### ***Conclusion***

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lan Vinh whose telephone number is 571 272 1471.

The examiner can normally be reached on M-F 8:30-5:30 PM.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571 272 1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to be 'LV' followed by a stylized flourish.

LV

September 21, 2007